107001

國立臺北科技大學 107 學年度碩士班招生考試

系所組別：2210 電子工程系碩士班甲組

第一節　計算機概論　試題

注意事項：

1.本試題共 6 題，共 100 分。

2.**請標明大題、子題編號依序作答，未作答之題目亦須列註題號**，不必抄題。

3.全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、簡答題：(100%)

1. Number systems. **(15%)**
   (1) Convert the decimal numbers 17 and −35 to 7-bit signed binary numbers. **(4%)**
   (2) What are the largest and smallest of 6-bit signed binary integers, with *two's complement*? Convert your answers to decimal. **(4%)**
   (3) Why do we prefer two's complement to represent integers? **(7%)**
2. Sorting algorithms. **(20%)**
   (1) What is a *stable* sort algorithm? **(2%)**
   (2) The *quick sort* algorithm is not stable. Explain how to make it stable. **(6%)**
   (3) What is the best-case and worst-case *asymptotic* running time of quick sort algorithm on n elements? Assuming a *uniformly random* distribution of the keys to be sorted, what is the asymptotic running time in the average case of quick sort algorithm on n elements? **(6%)**
   (4) Explain how to use *linear median selection* to improve the worst-case asymptotic running time of quick sort algorithm. **(6%)**
3. Hash tables vs. search trees. **(15%)**
   (1) What is the asymptotic worst-case time to insert an element to a *self-balancing search* tree, such as *red–black tree*? With assumptions of *uniform hashing*, what is the asymptotic worst-case time to insert an element to a *hash table*? **(4%)**
   (2) Explain the two major ways to resolve collision of hash tables. **(6%)**
   (3) While hash tables seem to outperform self-balancing search trees, why are search trees still commonly used? **(5%)**
4. Operating system concepts. **(20%)**
   (1) Define the term *deadlock*, and give an example of deadlock. **(6%)**
   (2) What are the conditions that must be satisfied to form a deadlock? **(9%)**
   (3) What is the major problem of a *layered* design of an operating system? **(5%)**
5. Computer networks. **(15%)**
   (1) Draw the *bus*, *star*, and *ring* topologies of networks. **(6%)**
   (2) Define and compare the following terms: *repeater*, *bridge*, and *switch*. **(9%)**
6. Artificial intelligence. **(15%)**
   (1) Briefly define and explain *Turing test*. **(7%)**
   (2) Adjust the *weights* and *threshold* value of the following *neuron* in an *artificial neural network* so that its output is 1 if and only if at least two of its inputs are 1s. **(8%)**